Q3 Critical Points

Code by Lipika Sharma

```
% i) Generate a third degree polynomial in x and y named g(x, y) that is based on yo
% My mobile no : 9131002201
% replacing0 with 3 (9131332231)
syms x y
f=(9*x^3 - 1*x^2*y + 3*x*y^2 -1*y^3 + 3*x^2 - 3*x*y + 2*y^2 - 2*x + 3*y-1)
```

$$f = 9x^3 - x^2y + 3x^2 + 3xy^2 - 3xy - 2x - y^3 + 2y^2 + 3y - 1$$

```
%ii) Write a code to find all critical points of g(x, y).
gradientf2 = jacobian(f,[x,y])
```

$$gradientf2 = \begin{pmatrix} 27x^2 - 2xy + 6x + 3y^2 - 3y - 2 & -x^2 + 6xy - 3x - 3y^2 + 4y + 3 \end{pmatrix}$$

```
% Hessian matrix (the square matrix of second partial derivatives)
Hessian_Matrix = jacobian(gradientf2, [x,y])
```

Hessian_Matrix =

$$\begin{pmatrix} 54x - 2y + 6 & 6y - 2x - 3 \\ 6y - 2x - 3 & 6x - 6y + 4 \end{pmatrix}$$

```
% calculate the first partial derivatives
[xcr2, ycr2] = solve(gradientf2(1),gradientf2(2));
disp ("Critical Points for Polynomial x1 and y1")
```

```
Critical Points for Polynomial x1 and y1
```

```
double([xcr2(1), ycr2(1)])
```

```
ans = 1×2 complex
  -0.0297 - 0.1225i  -0.5569 - 0.1075i
```

```
disp ("Critical Points for Polynomial x2 and y2")
```

```
Critical Points for Polynomial x2 and y2
```

```
double([xcr2(2), ycr2(2)])
```

```
ans = 1×2 complex
  -0.0297 + 0.1225i  -0.5569 + 0.1075i
```

```
disp ("Critical Points for Polynomial x3 and y3")
```

```
Critical Points for Polynomial x3 and y3
```

```
double([xcr2(3), ycr2(3)])
```

```
ans = 1×2 complex
  -0.1892 - 0.2419i   1.6464 - 0.2503i
```

```
disp ("Critical Points for Polynomial x4 and y4")
```